Intel® SDK for OpenCL™ Applications 2016 R3

Release Notes

3 November 2016

Version History/Revision History

These are the main releases of Intel® SDK for OpenCL™ applications:

Date	Revision	Description
October 2016	2016 R3	7th Generation Intel® Core™ Processor support, Microsoft Windows* 10 Anniversary Update, OpenCL 2.1 experimental CPU only runtime for Linux*
July 2016	2016 R2 (Linux)	GPU Kernel debugger Beta and kernel level analysis for Linux
June 2016	2016 R2 (Windows)	OpenCL 2.1 support, new features in Kernel Development Framework
April 2016	2016	GPU Kernel debugger Beta and standalone release for Linux
Nov. 17, 2016	2015 R3	Standalone release for Windows
April 28, 2015	2015 R2	Visual Studio 2015 support
Jan 22, 2015	2015 R1	Released as part of Intel® Integrated Native Developer Experience (Intel® INDE)

Customer Support

For technical support, including answers to questions not addressed in this product, visit the technical support forum, FAQs, and other support information at: Intel OpenCL Support or http://www.intel.com/software/products/support/.

Please remember to register your product at https://registrationcenter.intel.com/ by providing your email address. Registration entitles you to free technical support, product updates and upgrades for the duration of the support term. It also helps Intel recognize you as a valued customer in the support forum.

To provide feedback and suggestions or submit an issue, go to the Intel OpenCL Forum.

Contents:

1   Introduction

Intel® SDK for OpenCL™ applications assists with creating, building, debugging, and analyzing PC and mobile applications developed with OpenCL™ API on Windows*, Linux* and Android* OSes.

Please note: a driver/runtime package must also be installed to run applications developed with the SDK.

This document contains information about new features, system requirements, installation instructions, fixed bugs, limitations and known issues.

To learn more about the product, see:

- New features listed in the New in This Release section below, or in the help
- Reference documentation listed in the Related Documentation section below
- Installation instructions at Installation Notes

2   New in This Release

2.1   New Features

- **Support for 7th Generation Intel® Core™ Processors on Microsoft Windows* and Linux* operating systems**
- **Windows 10 Anniversary Update support**
- **Yocto Project* support**
  - These processors are supported as target systems when running the Apollo Lake Yocto BSP (other OSes are not supported for these processors): 7th Generation Intel® Pentium® Processor J4000/N4000 and 7th Generation Intel® Celeron® Processor J3000/N3000 Series for Desktop
  - Offline compiler support with GPU assembly code generation
  - Debug OpenCL™ kernels using the Yocto* GPU driver on host targets (6th and 7th Generation Intel® Core Processor)
- **OpenCL™ 2.1 and SPIR-V* support on Linux* OS**
  - OpenCL 2.1 development environment with the experimental CPU-only runtime for OpenCL 2.1
  - SPIR-V generation support with Intel® Code Builder for OpenCL™ offline compiler and Kernel Development Framework including textual representation of SPIR-V binaries
- **New analysis features in Kernel Development Framework for Linux* OS**
  - HW counters support
  - Latency analysis on 6th and 7th Generation Intel® Core™ Processors

Intel® SDK for OpenCL™ Applications 2016 R3 includes all the features for OpenCL development for Windows* previously available in Intel® SKD for OpenCL™ Application 2016 R2 and all features for Linux* development which available in Code Builder for Intel® Media Server Studio.
For a full list of features, refer to the Intel® SDK for OpenCL™ Applications Developer Guide.

3   Known Issues

3.1   General Limitations

- To work with the Google Android* NDK, the path to the SDK installation should not contain spaces.
- When working with the default Intel OpenCL™ Platform together with OpenCL 2.1 experimental platform there may be performance issues.
- If you are using the Eclipse* Mars IDE on the Linux* Ubuntu x64 system, set the `SWT_GTK3` environment prior running the IDE:
  `SWT_GTK3 = 0`

3.2   Code Builder IDE Plug-in Limitations

- Build feature limitations:
  - To work with the Intel® SDK for OpenCL™ - offline compiler plug-in for Microsoft Visual Studio* IDE on 64-bit OS, configure the Visual Studio for 64-bit applications (64-bit compiler and tools).
  - LLVM view for Intel® Processor Graphics device in the Offline Compiler plug-in for the Visual Studio IDE is not supported on "Compile" and "Link" options. To see the Intel® Processor Graphics LLVM code, use the **Build** option.
  - In order to work with Kernel Builder tool on Ubuntu* 14.04.3 version, need to set:
    `export LD_PRELOAD=/usr/lib/x86_64-linux-gnu/mesa/libGL.so.1`
    (find more information on Ubuntu Forums).
- Kernel Debugger Framework plug-in for Eclipse* IDE
  - On Ubuntu 14.04.x, if you encounter the following error:
    `Inconsistency detected by ld.so: dl-version.c: 224:`
    `_dl_check_map_versions: Assertion `needed != ((void *)0)' failed!`
    set the following environment variable to fix this issue:
    `LD_PRELOAD=/usr/lib/x86_64-linux-gnu/mesa/libGL.so.1`
- GPU Kernel Debugger for the Visual Studio IDE
  - The GPU kernel debugger is supported on 64-bit applications only.
- CPU Kernel Debugger for the Visual Studio IDE does not support:
  - Edit and continue capability
  - Multithreaded debugging
  - Two instances of Visual Studio running simultaneously
  - Unions
- OpenCL API Debugger
  - Concurrent debug sessions with **API Debugger** are not supported. This includes attaching the Visual Studio debugger to more than one process, or opening multiple instances of Visual Studio and debugging processes concurrently.
- Code Analyzer Limitations:
  - Kernel analysis features are not supported on 3rd Generation Intel Core processors with Intel® HD Graphics 4000
  - Latency and occupancy reports cannot be generated for built-in kernels which are generated with `clCreateProgramWithBuiltInKernels`

o Calling the API `clCreateProgramWithBuiltInKernels` or `clCreateAcceleratorINTEL` generates additional OpenCL APIs in the API Analyze report, these APIs do not appear in the code

o Occupancy analysis is not supported on an application that includes a call to Microsoft D3D11 API `GetData()`. Running Occupancy analysis on such an application leads to application crash with an exception

o Kernel analysis, HW counters and some of the hints are available only for kernels that run on GPU (shared context is not supported)

o Host and kernel level analysis are not supported on an application that uses the motion estimation extension

3.3 Known Installation and Configuration Issues

- If you encounter an issue with detecting OpenCL™ GPU devices after installing the SDK on your Microsoft Windows* OS machine, update the GFX driver for your platform to the latest version from https://downloadcenter.intel.com/.

- If the PATH environment variable exceeds 256 character length upon installation, you might encounter issues related to System32 directory use.

- In case of uninstallation through **Control panel** > **Uninstall a program** you may face the "*Error opening installation log file. Verify that the specified log file location exists and is writable*" error. It is a known issue in the Microsoft* data base at http://support.microsoft.com/kb/2564571. Use uninstallation icon in the **Start** menu or reboot the machine to proceed with the uninstallation.

- If the Mozilla Firefox* browser shows the Network Error (dns_unresolved_hostname) screen with the message "Your requested host "localhost" could not be resolved by DNS. For assistance, contact your network support team." instead of a report, please use the *"Auto-detect proxy settings for this network"* option: Options > Advanced > Network tab > Settings…

3.4 Intel® Processor Graphics Device Limitations

- For details on known issues with the OpenCL™ standard on the Intel® Processor Graphics, refer to the relevant driver release notes.

- Timeout Detection & Recovery (TDRs) may be observed when running OpenCL™ benchmarks including Kishonti CLBenchmark,Kishonti CompuBench CL*, and SiSoftware Sandra* (GP (GPU/CPU/APU) Processing OpenCL™ benchmarks). Also some OpenCL™ workloads may cause TDRs, especially workloads with complex, time-consuming kernels and large local work size or workloads that use profiling feature. Increase the TDR delay to avoid the TDRs. For details, refer to the article at https://msdn.microsoft.com/en-us/library/windows/hardware/ff570087(v=vs.85).aspx

- The OpenCL™ Driver is available on systems with Intel® Processor Graphics and discrete graphics cards (Microsoft Windows* OS only):
  o Capabilities of both discrete and integrated graphics are available if display is connected to:
    ▪ Integrated graphics card display port.
    ▪ Discrete and integrated graphics cards simultaneously.
  o Capabilities of a discrete card only are available if the display is connected to:
    ▪ Discrete graphics card display port.
    ▪ Integrated graphics card, and a discrete graphics card without display ports.

4 Related Documentation

Here is the documentation related to Intel® SDK for OpenCL™ applications:

- [Getting Started with Intel® Code Builder for OpenCL™ API](#)
- [Developer Guide for Intel® SDK for OpenCL™ Applications](#)
- [Developer Guide for Intel® Processor Graphics](#)

5 Where to Find the Release

To download the SDK: https://software.intel.com/en-us/intel-opencl.

For more info on how to choose which driver/runtime package you need and how to download it, please see https://software.intel.com/en-us/articles/opencl-drivers.

6 System Requirements

6.1 Supported Architectures and Terminology

For an explanation of architecture names, see http://software.intel.com/en-us/articles/intel-architecture-platform-terminology/.

The following matrix determines Intel processors support on Microsoft Windows*, Linux* and Android* operating systems.

6.1.1 Intel® SDK for OpenCL™ Applications *for Windows*:*

Intel® Platform	OpenCL version	SDK Platform	Target Application Platform	
		Windows* 8.1/10	Windows* 8.1/10	
			CPU	GPU
[NEW] 7th Generation Intel® Core Processors with Intel® Iris™ Pro Graphics and HD Graphics	2.1	✓	✓	✓
6th Generation Intel® Core Processors with Intel® Iris™ Pro Graphics and HD Graphics	2.0	✓	✓	✓
5th Generation Intel® Core Processors with Intel® Iris™ Pro Graphics and HD Graphics	2.0	✓	✓	✓
1st and 2nd Generation Intel® Core™ Processors & Intel® Xeon® Processor (**CPU only**)	1.2	✓	✓	
Intel® Xeon® Processor E3-1200 v4 Family with C226 chipset and E3-1500 v5 Family with C236 chipset	2.0	✓	✓	✓

6.1.2 Intel® SDK for OpenCL™ Applications *for Linux*:*

Intel® Platform	OpenCL version	SDK Platform		Target Application Platform					
		Ubuntu 14.04	CentOS 7.2	CentOS* 7.2		Ubuntu* 14.04		Yocto*	
				CPU	GPU	CPU	GPU (w/ generic drive)	CPU	GPU
[NEW] 7th Generation Intel® Core™ Processors with Intel® Iris™ Pro Graphics and HD Graphics	2.0	✓	✓	✓	✓	✓	✓		
[NEW] Intel® Pentium™ Processor N4200/5, N3350/5, N3450/5	2.0	✓				✓	✓	✓	✓
5th and 6th Generation Intel® Core™ Processors with Intel® Iris™ Pro Graphics and HD Graphics	2.0	✓	✓	✓	✓	✓	✓		
Intel® Xeon® Processor E3-1200 v4 Family with C226 chipset and E3-1500 v5 Family with C236 chipset	2.0	✓	✓	✓	✓	✓	✓		
1st-4th Generation Intel® Core™ Processors (CPU only)	1.2	✓	✓	✓		✓			
Intel® Xeon® Processor Product Family (CPU only)	1.2	✓	✓	✓		✓			

Note the following:

- For more information on OpenCL platforms and Oss support, go to Intel's OpenCL technology page at https://software.intel.com/en-us/intel-opencl.
- To run and use the Intel® Code Builder for OpenCL™ API IDE plug-in, you must have a PC based on an IA-32 or Intel 64 architecture processor.
- Incompatible or proprietary instructions in non-Intel processors may cause the analysis capabilities of this product to function incorrectly. Any attempt to analyze code not supported by Intel processors may lead to failures in this product.
- You must have administrator privileges to install and use the Intel® SDK for OpenCL™ Applications 2016 R3 on Microsoft Windows* operating systems.
- You must have root privileges (or use the sudo command) to run the Intel® SDK for OpenCL™ Applications 2016 R3 on Linux* operating systems (including launching the Eclipse* IDE).
- Intel® SDK for OpenCL™ Applications for Linux* is compatible with the following OpenCL drivers and runtimes:
  - OpenCL™ 2.0 Driver for Intel® HD, Iris™, and Iris™ Pro Graphics for Linux (64-bit)
  - OpenCL™ Runtime 16.1.1 for Intel® Core™ and Xeon™ processors

  For more information on the supported runtime and drivers, go to **OpenCL™ Drivers and Runtimes for Intel® Architecture** https://software.intel.com/en-us/articles/opencl-drivers.

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- Intel® SDK for OpenCL™ Applications provides Android* OS support only on rooted devices with Intel® processors.
- Intel® SDK for OpenCL™ Applications plugin for the Eclipse* IDE requires Java Runtime Environment 1.8 installed on your Microsoft Windows* or Linux* machine.

6.2 Driver Requirements

6.2.1 Windows* Driver Requirements:

For OpenCL™ support on Intel® processors with Intel® Processor Graphics you must have an Intel® Graphics Driver (version 15.36 or higher) installed. For more information please see the driver support matrix at

https://software.intel.com/en-us/articles/driver-support-matrix-for-media-sdk-and-opencl

and **OpenCL™ Drivers and Runtimes for Intel® Architecture** at https://software.intel.com/en-us/articles/opencl-drivers

6.2.2 Linux*Driver and Runtime Requirements:

For OpenCL™ support on Intel® processors with Intel® Processor Graphics you must have an OpenCL graphics driver or CPU-only runtime package installed.

For more information on supported runtimes and drivers for Linux* go to **OpenCL™ Drivers and Runtimes for Intel® Architecture** at https://software.intel.com/en-us/articles/opencl-drivers.

6.2.3 Eclipse* Plug-in Requirements

The Eclipse* plug-in requires Java Runtime Environment 1.8 or higher installed.

7 Installation Notes

7.1 Installation on Microsoft Windows* OS

For OpenCL™ support on Intel® processors with Intel® Processor Graphics you must have the Intel® Graphics Driver (version 15.36 or higher) installed.

You can obtain the latest driver version using the Intel® Driver Update Utility, or manually here

You can obtain Intel® SDK for OpenCL™ Applications installer from the SDK web page:
https://software.intel.com/en-us/intel-opencl

You must have administrator privileges to install and use the SDK on Microsoft Windows* operating systems.

Before installing the Intel® SDK for OpenCL™ Applications for Windows operating systems it is recommended to remove any previous version of the SDK from your computer.

To install the Intel® SDK for OpenCL™ Applications on Windows operating systems, run the installation package and follow the installer prompts.

The SDK installation includes the following components:

- OpenCL code C header files and libraries
- Kernel Builder standalone utility 32- and 64-bit version
- Offline Compilation command-line utility 32- and 64-bit version
- OpenCL Code Builder plug-in for Microsoft Visual Studio* 2012 and higher including comprehensive environment for building, debugging and analyzing OpenCL applications.
- OpenCL Code Builder plug-in for Eclipse* 4.2 and higher including Kernel Development Framework for building OpenCL applications,

NOTE: Intel graphics driver includes OpenCL support for both CPU and Intel® Processor Graphics.

7.1.1 Uninstalling Intel® SDK for OpenCL Applications
To remove SDK components use the Control Panel or select **Start > All Programs > Intel SDK for OpenCL Applications 2016 R3 > Uninstall**

7.1.2 Setting Environment Variables on Microsoft Windows* OS Manually
The product installation process makes a few system environment modifications. If the environment variables become corrupted on the installed system, you can correct this issue by ensuring that the environment variables are defined as follows.

The `INTELOCLSDKROOT` variable must be set to the target installation directory. The default installation directory is
`C:\Program File(x86)\Intel\OpenCL SDK\6.3`

Also make sure that the installation folder is in the system `PATH` environment variable.

7.1.3 Default Installation Folders
The default top-level installation folder for this product is:

- C:\Program Files (x86)\Intel\OpenCL SDK

If you are installing on a system with a non-English language version of Windows OS, the name of the `Program Files` folder may be different. On Intel® 64 systems, the directory name is `Program Files (X86)` or the equivalent.

7.2 Installation on Linux* OS

You can obtain the Intel® SDK for OpenCL™ applications installer from the SDK web page: https://software.intel.com/en-us/intel-opencl

A driver or runtime package must also be installed. https://software.intel.com/en-us/articles/opencl-drivers

Intel® SDK for OpenCL™ applications 2016 R3 for Linux* installation package is delivered in the form of archives containing RPM packages with installer scripts for easy installation/uninstallation procedures. Installer provides both common-line and graphical user interface modes. You can use any of the approaches (use command-line or graphical user interface directly).

There are two installation packages available – one for Ubuntu* 14.04 OS and one for CentOS* 7.2.   Please note: SDK install on other Linux distros like RHEL 7.2* and SLES 12.1* may also be possible but this does not imply driver support.

All RPM packages of the Intel® SDK for OpenCL™ applications are digitally signed.

To install the product:

1. Extract the TGZ archive contents:
```
# tar xzf intel_sdk_for_opencl_2016_6.3.0.<VERSION>_x64.tgz

# cd intel_sdk_for_opencl_2016_6.3.0.<VERSION>_x64
```

2. Run the following command (for command-line interface) and follow the installer prompts:
```
# ./install.sh
```

3. Alternatively (for installation with graphical user interface) run the following command:
```
# ./install_GUI.sh
```

To install the Eclipse plugin:

1. Copy the plugin from `/etc/alternatives/opencl-intel-tools/eclipse-plug-in/CodeBuilder_6.3.0.jar` to the Eclipse* dropins folder.

2. Remove previous versions of the plugin from the Eclipse* dropins folder.

NOTE: All RPM packages of the Intel SDK for OpenCL Applications are digitally signed.

After downloading, you can verify the signature of the RPM package:

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1. Extract the public key from the installation archive file.
2. Import public key into rpm database by use of the following command:
   ```
   # sudo rpm --import Intel-E901-172E-EF96-900F-B8E1-4184-D7BE-0E73-F789-186F.pub
   ```
3. Verify signature of RPM package:

   ```
   # rpm --checksig <rpm name>.rpm
   ```

   where `<rpm name>` is the name of the RPM package.

   Expected output for RPM with a valid digital signature is:
   ```
   <rpm name>.rpm: rsa sha1 (md5) pgp md5 OK
   ```

7.2.1 Uninstalling from Linux* OS

To uninstall the product, do the following:

1. Go to the folder to which you extracted the TGZ archive content.

2. Run the following command (for command-line interface) from the installed product location and follow the installer prompts:

   ```
   # /etc/alternatives/opencl-intel-tools/uninstall.sh
   ```

4. Alternatively (for uninstallation with graphical user interface), run the following command from the installed product location and select uninstall option:

   ```
   # /etc/alternatives/opencl-intel-tools/uninstall_GUI.sh
   ```

7.3 Installing OpenCL™ on the Android* Emulator

To install the Intel's OpenCL runtime on the Android* Emulator using the script, do the following:

1. Go to the `android-preinstall` subfolder of the Intel® SDK for OpenCL™ applications installation folder.
2. Use the `OpenCL_Android_Install` script to configure the emulator or Android device or use the following options to start the emulator manually:

   ```
   OpenCL_Android_Install –d <your device/emulator>
   ```

- Root permissions are required on Android devices and emulator.
- Note that on Microsoft Windows* OSs only one device can be running at installation time.

To manually install the OpenCL runtime on the emulator, do the following:

1. Copy the following files from the SDK installation folder to `/system/vendor/lib` using the Android* Debug Bridge:

   o   `__ocl_svml_g9.so`
   o   `__ocl_svml_n8.so`

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- o   `__ocl_svml_s9.so`
- o   `__ocl_svml_v8.so`
- o   `clbltfng9.rtl`
- o   `clbltfng9_img_cbk.o`
- o   `clbltfng9_img_cbk.rtl`
- o   `clbltfnn8.rtl`
- o   `clbltfnn8_img_cbk.o`
- o   `clbltfnn8_img_cbk.rtl`
- o   `clbltfns9.rtl`
- o   `clbltfns9_img_cbk.o`
- o   `clbltfns9_img_cbk.rtl`
- o   `clbltfnv8.rtl`
- o   `clbltfnv8_img_cbk.o`
- o   `clbltfnv8_img_cbk.rtl`
- o   `libcl_logger.so`
- o   `libclang_compiler.so`
- o   `libcpu_device.so`
- o   `libgnustl_shared.so`
- o   `libintelocl.so`
- o   `libOclCpuBackEnd.so`
- o   `libOclCpuDebugging.so`
- o   `libOpenCL.so.1.2`
- o   `libtask_executor.so`
- o   `libtbb_preview.so`
- o   `libtbbmalloc.so`
- o   `opencl_.pch`

3. Use the following command to copy the files:

   ```
   adb -s <Emulator-Name> push <file1> /system/lib
   ```

4. In the `/system/lib` folder on the Android device, create two links:
   ```
   adb -s <Emulator-Name> shell 'cd /system/vendor/lib; ln -s libOpenCL.so.1
   libOpenCL.so; ln -s libOpenCL.so.1.2 libOpenCL.so.1'
   ```
5. Create the ICD using the following command:

   ```
   adb -s <Emulator-Name> mkdir -p /system/vendor/Khronos/OpenCL/vendors

   adb -s <Emulator-Name> shell "echo libintelocl.so >
   /system/vendor/Khronos/OpenCL/vendors/intel.icd"
   ```

NOTE: If you close the emulator, you must reinstall the OpenCL runtime after you run it again.

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8 Attributions

Android NDK

Android NDK is used for Android support, from ANDROID NDK distribution:

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Windows Installer XML

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